

What is claimed is:

1. A process for recovering a precious metal from a precious metal-containing material, comprising:
 - (a) providing a heap of the precious metal-containing material; and
 - 5 (b) passing a thiosulfate lixiviant and molecular oxygen through the heap to form a pregnant leach solution comprising dissolved precious metals, wherein the molecular oxygen is at a pressure greater than its ambient atmospheric pressure before introduction into the heap.
2. The process of claim 1, wherein the molecular oxygen is in the form of a gas and the thiosulfate lixiviant and molecular oxygen flow countercurrently through the heap.
3. The process of claim 1, wherein the molecular oxygen is introduced under pressure into the heap by a network of conduits positioned in the base of the heap.
4. The process of claim 1, wherein the thiosulfate lixiviant has a pH of no more than about 9 before introduction to the heap and wherein the precious metal-containing material is agglomerated.
5. The process of claim 1, wherein the thiosulfate lixiviant has a free ammonia content of no more than about 2,000 ppm and a dissolved copper content of no more than about 20 mg/L.

6. The process of claim 1, wherein at least about 0.5 kg of molecular oxygen/ton of heap material is introduced into the heap during leaching.

7. The process of claim 1, wherein a dissolved molecular oxygen content of the lixiviant is at least about 1 mg/L.

8. A precious metal recovered by the process of claim 1.

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9. A process for recovering a precious metal from a carbonaceous precious metal-containing material, comprising:

(a) providing a refractory, carbonaceous precious metal-containing material;
and

5 (b) contacting the carbonaceous precious metal-containing material with a thiosulfate-containing lixiviant, wherein the lixiviant contains a blinding agent.

10. The process of claim 9, wherein the blinding agent includes one or more of hydrocarbons, alcohols, esters, aldehydes, surfactants, lauryl sulfonates, phosphates; guar gum, starch, cellulose, and metal salts.

11. The process of claim 9, wherein the thiosulfate lixiviant includes at least about 0.1 mg/L blinding agent.

12. The process of claim 9, wherein the thiosulfate lixiviant includes at least about 1 mg/L blinding agent.

13. The process of claim 9, wherein the thiosulfate lixiviant includes from about 2 to about 200 mg/L blinding agent.

14. A precious metal recovered by the process of claim 9.

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15. A process for recovering a precious metal from a precious metal-containing material, comprising:
- (a) providing a particulate precious metal-containing material;
 - (b) contacting the precious metal-containing material with a thiosulfate
 - 5 lixiviant and a calcium-containing material;
 - (c) after the contacting step, forming the precious metal-containing material into agglomerates, wherein the agglomerates comprise particles of the precious metal-containing material, thiosulfate lixiviant, and calcium-containing material;
 - (d) forming the agglomerates into a heap; and
 - 10 (e) thereafter passing the thiosulfate lixiviant through the heap to form a pregnant leach solution in which at least most of the precious metal content of the precious metal-containing material is dissolved.

16. The process of claim 15, wherein the calcium-containing material is a base.

17. The process of claim 15, wherein the calcium-containing material is at least one of calcium carbonate, calcium oxide, calcium chloride, calcium nitrate, calcium thiosulfate, calcium hydroxide, and mixtures thereof.

18. The process of claim 15, wherein the agglomerates further comprise copper.

19. The process of claim 15, wherein the agglomerates further comprise a base other than the calcium-containing material.

20. The process of claim 15, wherein the calcium content of the agglomerates is at least about 0.1 kg/tonne of agglomerates.

21. The process of claim 18, wherein the agglomerates comprise at least about 1 gram/tonne of added copper.

22. The process of claim 15, wherein the agglomerates comprise at least one of particles of cement and a blinding agent.

23. A precious metal recovered by the process of claim 15.

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24. A process for recovering a precious metal from a precious metal-containing material, comprising:

(a) contacting a thiosulfate lixiviant with a precious metal-containing material to form a pregnant leach solution, the pregnant leach solution comprising a dissolved
5 precious metal, thiosulfate, polythionate, and sulfate; and

(b) maintaining a dissolved sulfate concentration in the pregnant leach solution of no more than about 150 g/L.

25. The process of claim 24, wherein the maintaining step comprises:

(c) precipitating sulfates with calcium.

26. The process of claim 24, wherein the maintaining step comprises:

(c) removing sulfates from at least a portion of the pregnant leach solution and/or a solution derived therefrom.

27. The process of claim 25, wherein the calcium is selected from the group consisting essentially of calcium carbonate, calcium oxide, calcium chloride, calcium nitrate, calcium thiosulfate, calcium hydroxide, and mixtures thereof.

28. The process of claim 25, further comprising:

(d) contacting the calcium with the pregnant leach solution and/or a solution derived therefrom, and wherein the amount of calcium is at least about 0.1 kg/tonne of precious metal-containing material.

29. A precious metal recovered by the process of claim 24.

30. A process for recovering a precious metal from a metal-containing material, comprising:

(a) contacting a metal-containing material with thiosulfate to form a pregnant leach solution comprising thiosulfate and at least a portion of the metal in the metal-containing material;

(b) contacting the pregnant leach solution and/or a solution derived therefrom with a sulfide reagent to form a precipitate-containing slurry comprising the metal sulfide precipitates and elemental sulfur; and

(c) contacting at least one of the precipitate-containing slurry and the metal precipitates with a sulfite reagent to convert at least most of the elemental sulfur into thiosulfate.

31. The process of claim 29, further comprising, before step (c):

(d) separating the metal precipitates from the precipitate-containing slurry and wherein the metal precipitates are contacted with the sulfite reagent.

32. The process of claim 29, wherein the metal is a precious metal and further comprising:

(d) separating a liquid phase of the product of step (c) from a solid phase thereof, wherein the liquid phase comprises at least most of the thiosulfate in the product and the solid phase comprises at least most of the metal in the product.

33. The process of claim 31, further comprising:

(e) recycling the liquid phase to the contacting step (a).

34. The process of claim 31, wherein the solid phase comprises first and second metals and further comprising:

(e) contacting the solid phase with at least one of a mineral acid and an oxidant other than the mineral acid to precipitate the first metal but not the second metal;

5 and

(f) separating the precipitated first metal from the dissolved second metal.

35. The process of claim 33, wherein the first metal is a base metal and the second metal is a precious metal.

36. A metal recovered by the process of claim 29.